ELECTRONICS FOR MEASUREMENT • COMPUTATION • TELEMETRY • CONTROL

INSTRUCTION MANUAL
for
LINE DRIVING AMPLIFIER
MODEL
GSA-5/GSA-6

DCS DATA-CONTROL SYSTEMS INC.
Instrumentation for Research

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INSTRUCTION MANUAL

LINE DRIVING AMPLIFIER

MODELS GSA-5/GSA-6

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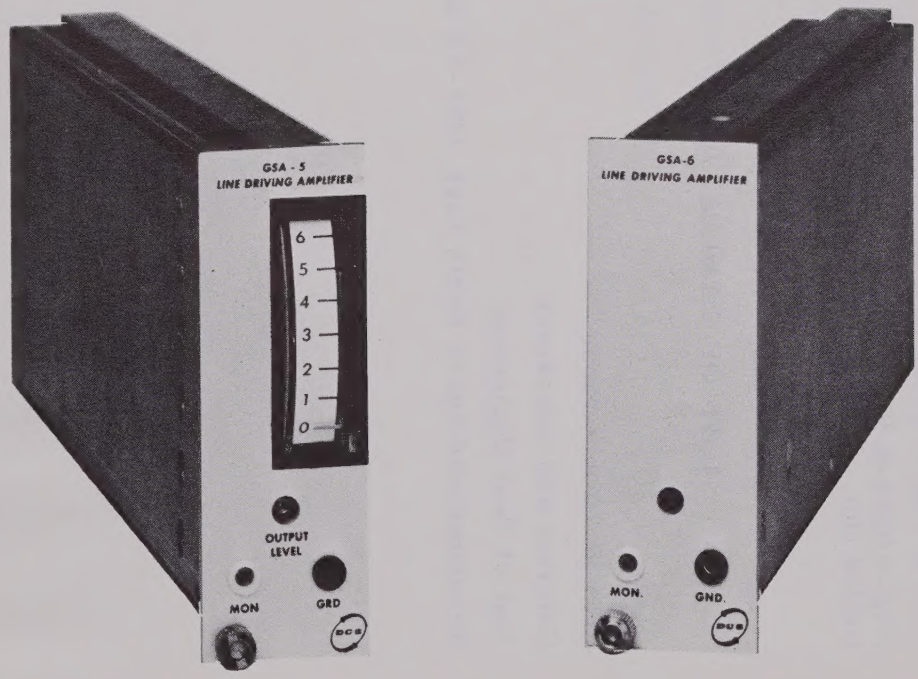


Figure 1-1. GSA-5/GSA-6 Line Driving Amplifier

SECTION I

GENERAL DESCRIPTION AND LEADING PARTICULARS

1-1. GENERAL.

1-2. This publication contains information necessary for understanding, operating, and maintaining the Models GSA-5 and GSA-6 Line Driving Amplifiers, Figure 1-1, designed and manufactured by Data-Control Systems, Inc., Commerce Drive, Danbury, Conn.

1-3. This information is presented in the following sections: Section I, General Description and Leading Particulars, Section II, Installation, Section III, Operation, Section IV, Theory of Operation, Section V, Maintenance and Troubleshooting, Section VI, Drawings, and Section VII, Difference Data.

1-4. The GSA-5 and GSA-6 are the same except that the GSA-6 does not include a front panel meter and its associated circuitry. Since the GSA-5 and GSA-6 are alike except for the meter circuit, the designation GSA-5/GSA-6 will be used throughout the rest of this manual. Areas of discussion which are not applicable to the GSA-6 will be noted.

1-5. PURPOSE AND SCOPE.

1-6. The Model GSA-5/GSA-6 is a wide band amplifier designed for summing frequency spectrums ranging up to 10 MHz or the single high frequency output of a voltage controlled oscillator. Channels or modulators may be added or removed without circuitry change since the summing networks are arranged to maintain the amplitude of the input signal, for each channel, at the desired level. This results in a constant peak-to-peak output capable of driving a 51 ohm load, independent of the number of channels removed or added. A reference frequency may be summed with the multiplex through an integral buffer amplifier, permitting the addition of a reference tone to any number of multiplexes. Figure 1-2 shows a typical system utilizing the GSA-5/GSA-6.

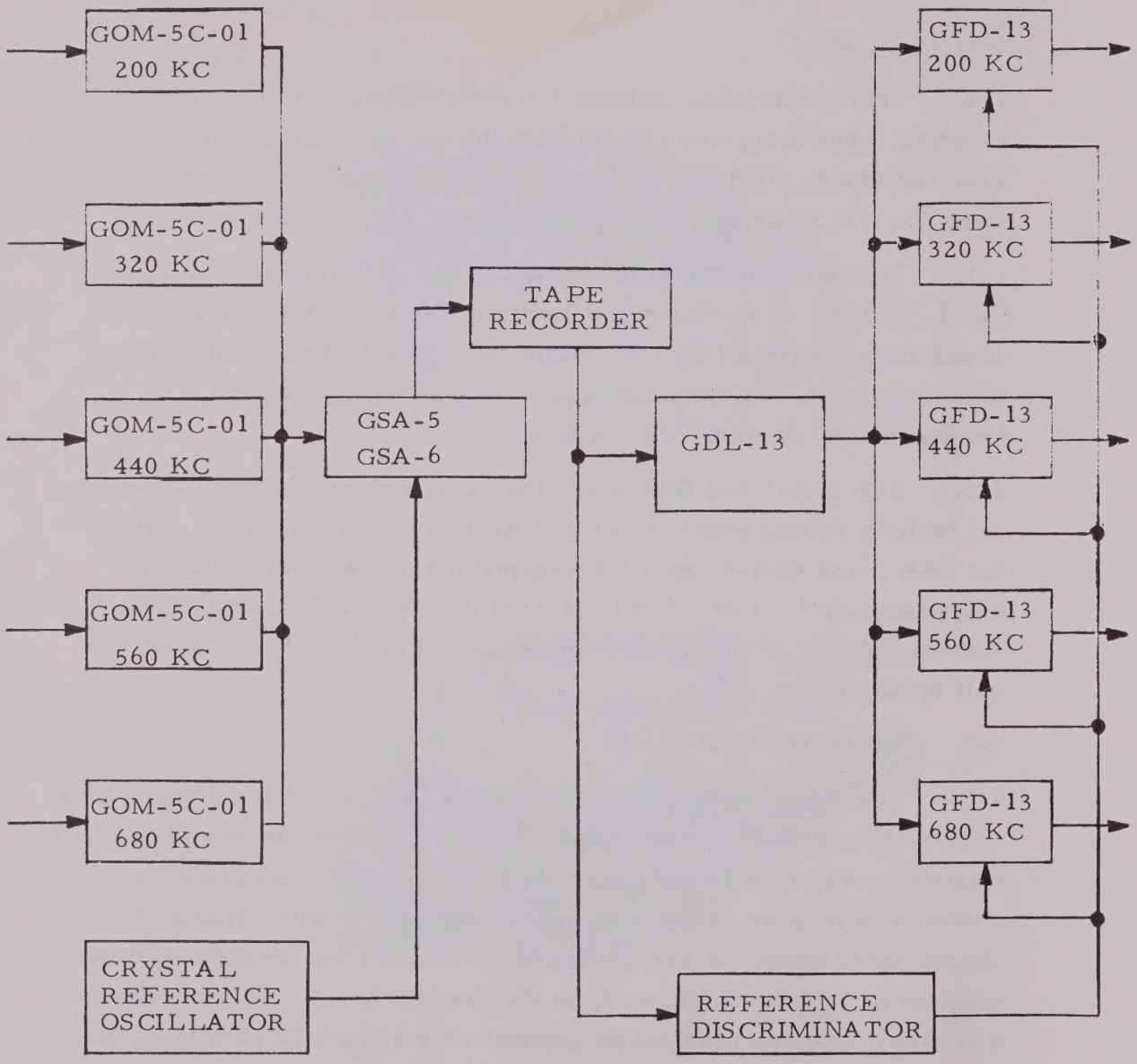


Figure 1-2. Typical Five Channel Constant Bandwidth System using a GSA-5/GSA-6.

1-7. PHYSICAL CHARACTERISTICS. The GSA-5/GSA-6 is used with a DCS type GMA Module Housing which will accommodate 14 modular units of this type side by side. Units are locked in a single modular space by a captive screw. The front panel mounts an output level meter, and output level adjustment and output and ground monitor jacks. The unit weighs 14 ounces and has dimensions of 1.11" wide x 3.29" high.

1-8. ELECTRICAL CHARACTERISTICS. The electrical characteristics of the GSA-5/GSA-6 are listed below:

Gain:	A gain of at least 20 at maximum output setting
Input Impedance:	500 ohms nominal, shunted by approximately 120 pf, single-ended, grounded
Output Level:	Maximum 6 volts peak-to-peak for open circuit or 3 volts peak-to-peak at rated load of 51 ohms
Output Impedance:	Nominal 51 ohms, single ended
Frequency Response:	Within +1 -3 db from 200 Hz to 10 MHz
Intermodulation Distortion:	For 4 MHz and 5 MHz, inputs with amplitudes equivalent to normal signal inputs, the 1 MHz difference frequency remains less than 40 db below the other two terms
Power Requirements:	All voltages supplied by GMA Module Assembly are as follows: ±18 Vdc and +12 Vdc, 35 Vdc

1-9. All connections to the GSA-5/GSA-6 are made in the rear of the module through an Elco Varicon connector. Elco pin connections and functions are called out in Table 1-1.

Table 1-1. Elco Pin Connections

Pin Number	Designation
1	No Connection
2	No Connection
3	No Connection
4	+12 V
5	Ground
6	Summing Bus (Input)
7	-12 V
8	-35 V
9	+18 Volts Unregulated
10	-18 Volts Unregulated
11	Reference Frequency Output
12	Ground
13	Reference Frequency Input
14	Ground
15	No Connection
16	No Connection
17	No Connection
18	No Connection
19	Output
20	Ground

SECTION II

INSTALLATION

2-1. GENERAL.

2-2. This section covers the initial procedures required to prepare the GSA-5/GSA-6 for operation. The scope of this information precludes actual operation of the equipment.

2-3. UNPACKING AND HANDLING.

2-4. The unit is sealed in a moisture proof polyethelene blister pack assembly and insulated from shock during shipment with polyurethane foam packing material.

2-5. Remove the corrugated carton and packing material and perform a general visual inspection. Retain carton and covering until inspection is completed.

2-6. MOUNTING.

2-7. The Line Driving Amplifier is designed to be mounted in a DCS type GMA Module Housing which contains the power supply and the proper wiring for interconnection. To install the GSA-5/GSA-6, proceed as follows:

a. Note the proper designation on the bottom edge of the GMA Module Housing. Insert the GSA-5/GSA-6 into the designated single module space and apply pressure until connectors engage.

b. Rotate the captive screw until it is completely installed.

2-8. COOLING.

2-9. Each GMA Module Housing is equipped with a muffin fan which pressurizes to 0.2 inches of water and forces cooling air over the GSA-5/GSA-6 stabilizing its operating temperature.

2-10. LUBRICATION. If the GMA Module Assembly is used in temperatures exceeding 110°F, or in areas of severe vibration, the muffin fan should be lubricated at least once a year to ensure reliable performance.

NOTE

A hypodermic type oil injector must be used to lubricate the fan. To inject the oil, pierce the label and concealed self-sealing rubber cap located under the label.

SECTION III

OPERATION

3-1. GENERAL.

3-2. This section describes the operating procedure for the GSA-5/GSA-6.

3-3. CONTROLS AND INDICATORS.

3-4. Table 3-1 lists the front panel controls and indicators.

Table 3-1. Controls and Indicators

Control/Indicator	Location	Function
Output Monitor Jack	Lower Left	Monitors Output Signal
Output Level Control	Lower Center	Adjusts Output Signal Level
Output Meter	Center	Indicates Output V p-p
Grd. Monitor	Lower Right	Monitors Ground Signal

NOTE

The GSA-6 does not have an output meter.

3-5. OPERATING PROCEDURE.

3-6. It is assumed that the unit has already been installed in the GMA Housing as described in Section II. See Figure 3-1 for a front panel view. To operate the unit, proceed as follows:

a. Set the associated GMA power switch to the ON position.

b. Allow a 15 minute warmup period.

c. With the rack blower assembly switch in the OFF position, check the air flow at the GMA panel openings to be sure the muffin fan is operating. When modules are missing from the GMA, use a blank panel, GBP-1 or GBP-2, to maintain cooling air pressure.

d. Adjust Output Level Control full clockwise and apply a 100 kHz, 300 MVPP signal to the GSA-5/GSA-6 input (Elco pin 6).

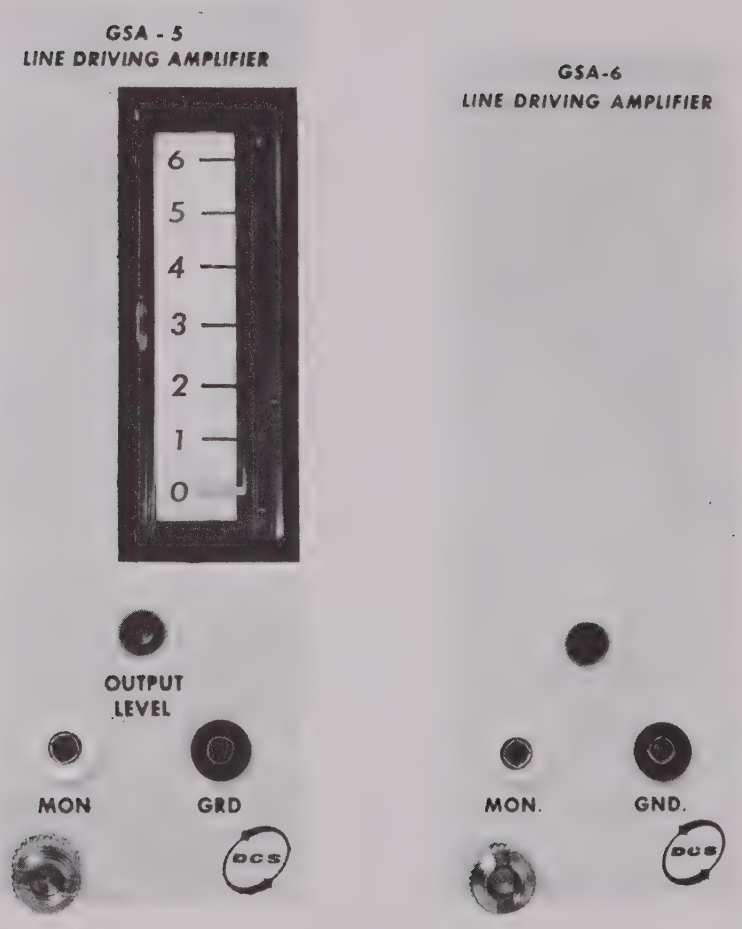


Figure 3-1. Front Panel View, GSA-5/GSA-6

e. Monitor the output (Elco pin 19) for a signal greater than 6 VPP and while varying the Output Level Control, observe the output amplitude changing.

f. Apply a 100 kHz 600 MVPP signal to input (Elco pin 13) and monitor output (Elco pin 11) for a signal of approximately 600 MVPP.

g. In order to turn the GSA-5/GSA-6 off, it is necessary to throw the GMA power switch to the off position or loosen the captive screw and disengage the module from the GMA master board by pulling the unit out a few inches.

SECTION IV

THEORY OF OPERATION

4-1. GENERAL.

4-2. This section describes the theory of operation of the GSA-5/ GSA-6 with reference to the Functional Block Diagram of Figure 4-1 and Schematic Drawings TW-017655 and TW-018627.

4-3. GSA-5/ GSA-6 THEORY OF OPERATION.

4-4. The GSA-5/GSA-6 consists of two operational amplifiers connected in cascade, a meter circuit across the output for peak-to-peak output readings, and a buffer amplifier to accept a separate reference input signal (see Figure 4-1).

NOTE

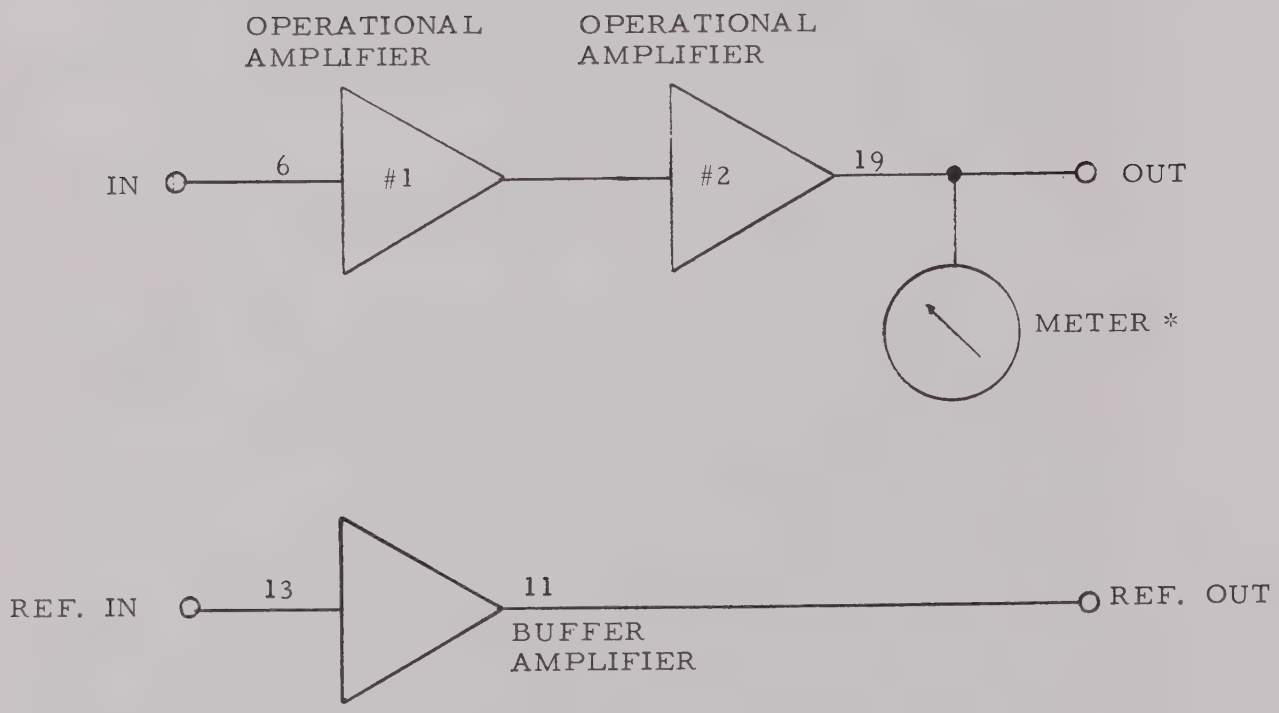
Any reference to the meter circuitry does not apply to GSA-6.

4-5. OPERATIONAL AMPLIFIER #1. The first operational amplifier (consisting of Q101, Q102, Q103, and Q104) is fed an input multiplex signal through C128, R301, C101, R101, and R102 into the base of Q101. R301 (Output Level Control) controls the output amplitude of the GSA-5/GSA-6.

4-6. The signal is transferred to the emitter of Q103 (the base of this transistor is held at a constant dc voltage by the zener action of Q102), fed into the base of Q104, and taken from emitter of Q104.

4-7. The total gain of this stage is determined by the ratio of R106 and R101. In drawing TW-017655, R106 is 5.11 K ohms and R101 is 1 K ohm. The ratio of these resistors is approximately 5:1 and the gain of the stage is 5.

4-8. OPERATIONAL AMPLIFIER #2. The second operational amplifier consists of Q105 through Q113. Transistors Q105, Q106, and Q107 serve the same function as Q101, Q102, and Q103, respectively.



* GSA-6 has no meter

Figure 4-1. Model GSA-5/GSA-6 Simplified Functional Block Diagram

4-9. The output of Q107 feeds Q108, an NPN transistor and simultaneously drives Q110, a PNP transistor. Emitter follower, Q108 provides parallel inputs to Q109 and Q111. Emitter follower Q110 drives Q112 and Q113.

4-10. Q109 and Q111 comprise one side of a push pull amplifier and Q112 and Q113 the other side. A portion of the output of this amplifier is fed back to the input via R115 and, together with R113, determines the gain of the stage.

4-11. The output of the amplifier is fed into the RC circuit R135, C112 and C113 and then applied to the output via Elco pin 19 of the GSA-5/GSA-6 connector.

4-12. The metering circuit consists of Q114 and CR101. It is connected between the output and ground and measures the peak-to-peak output voltage as applied to Elco pin 19.

4-13. A buffer amplifier consisting of Q115 and Q116 with an independent input and output and is used to add a reference signal to the multiplex input if desired. A high input impedance is provided by Q115 (FET) and the overall gain of the amplifier is unity.

NOTE

Paragraph 4-12 does not apply to GSA-6.

SECTION V

MAINTENANCE

5-1. GENERAL.

5-2. This section covers general maintenance and troubleshooting for the GSA-5/GSA-6. The location of major components are referenced in assembly drawings RA-017722 and RA-018630, and in Figure 5-1.

5-3. TEST EQUIPMENT.

5-4. Test equipment is listed in Table 5-1.

Table 5-1. List of Test Equipment

Nomenclature	Characteristics
Oscillator	HP 651A or equivalent
Volt Meter	HP 400CD or equivalent
Resistance Decade Box	Eico 1171 or equivalent
Oscilloscope	Tektronix 535 or equivalent
Volt Ohmmeter	Simpson 260 or equivalent
Frequency Counter	TSI 373/R or equivalent
GTF-2	DCS Test Fixture

5-5. PREVENTIVE MAINTENANCE.

5-6. VISUAL INSPECTION. Remove cover and inspect all elements for physical signs of damage such as broken or leaking components, burned or charred spots on resistors or capacitors, loose or oxidized soldered wires, and spread or bent Elco pins.

5-7. CLEANING. Since cooling air is constantly flowing through the equipment, the main blower rack should be properly filtered. The rack should be cleaned periodically with a standard vacuum cleaner. Panel and covers may be cleaned with a suitable solvent such as carbon met. Interior parts must be air blown.

NOTE

The components contained within the dotted lines are used by the GSA-5 only.

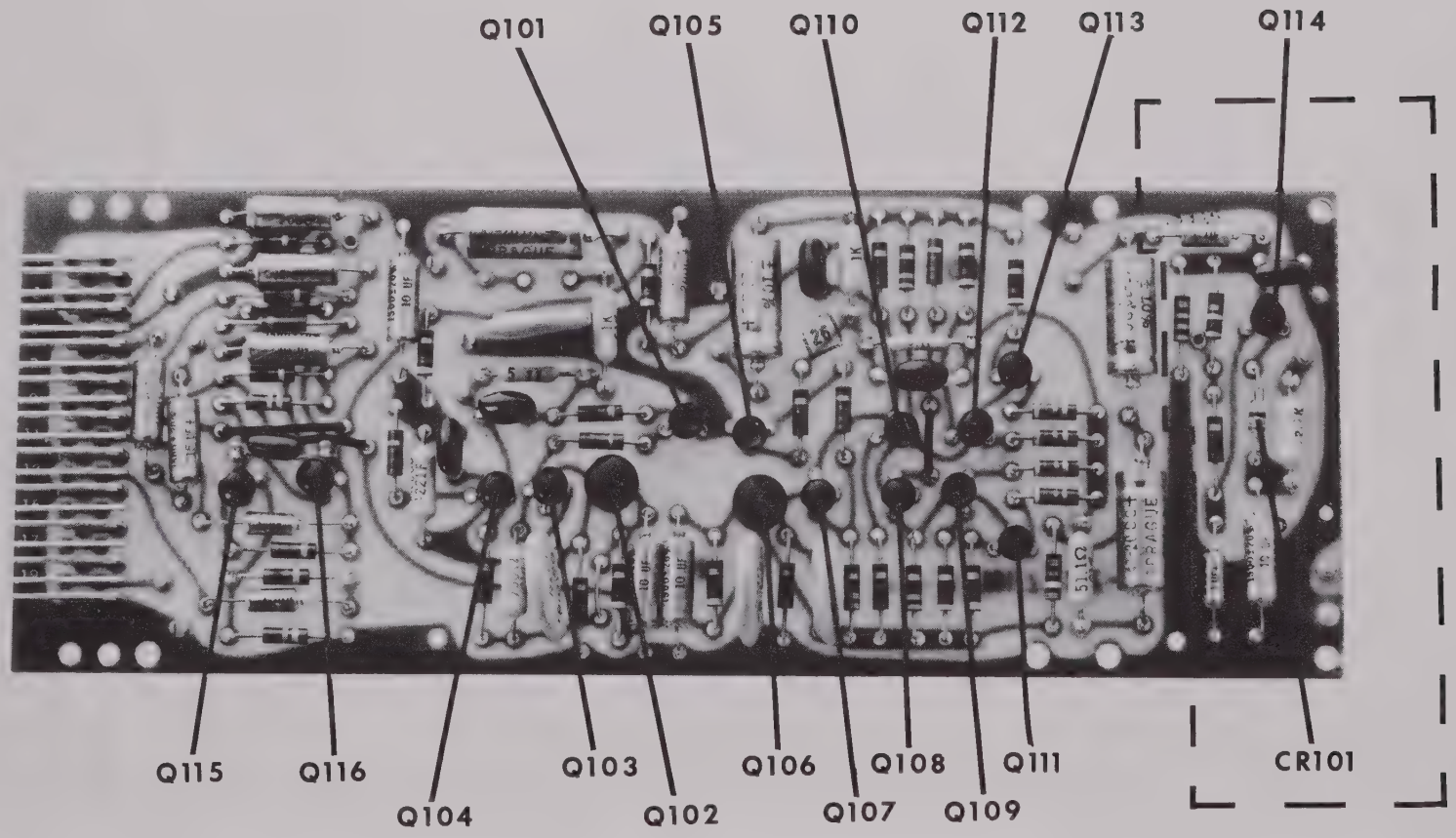
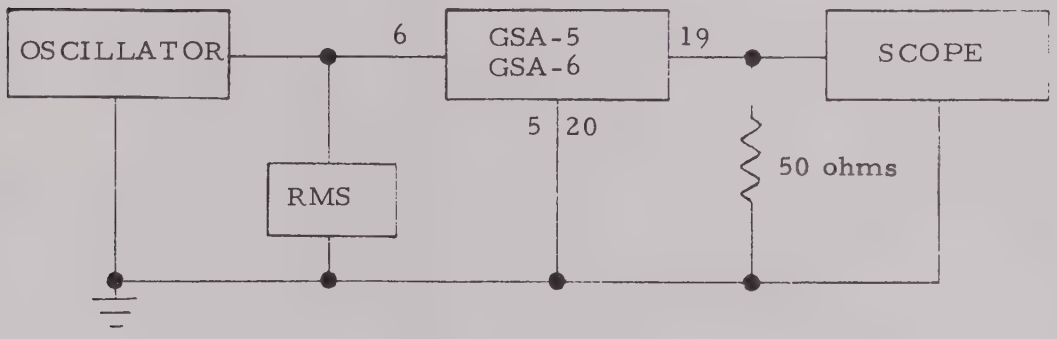


Figure 5-1. GSA-5/GSA-6 With Major Components Called Out

5-8. MINIMUM PERFORMANCE TESTS.

5-9. The minimum performance tests required to ensure proper operation of the equipment are described in this section. If performance falls below operating specifications, the cause must be determined through troubleshooting procedures.

5-10. INPUT LEVEL. Set up the equipment as shown below and proceed as follows: (Insert the GTF-2 into the GMA Housing and plug the GSA-5/GSA-6 into the GTF-2.)



a. Turn power on and allow a 15-minute stabilization period.

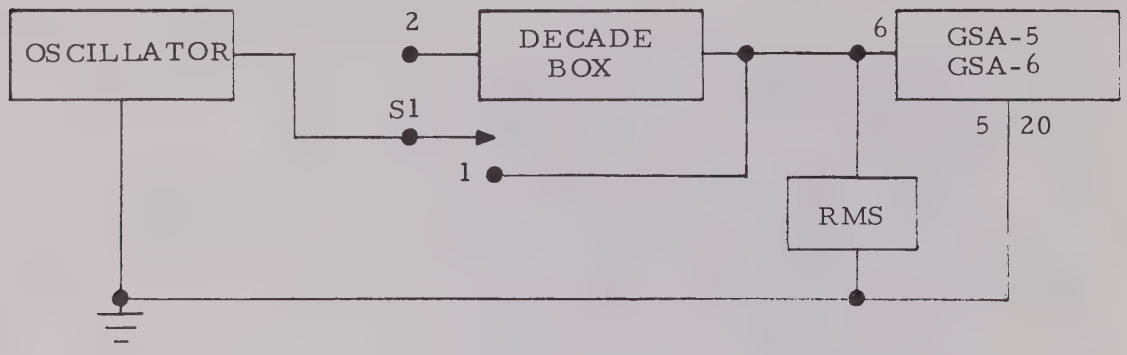
b. Set the oscillator to any frequency between 200 Hz and 10 MHz with an amplitude of 0.1 volts RMS.

c. Set the OUTPUT LEVEL adjust fully clockwise.

d. Increase input level until waveform on scope becomes distorted.

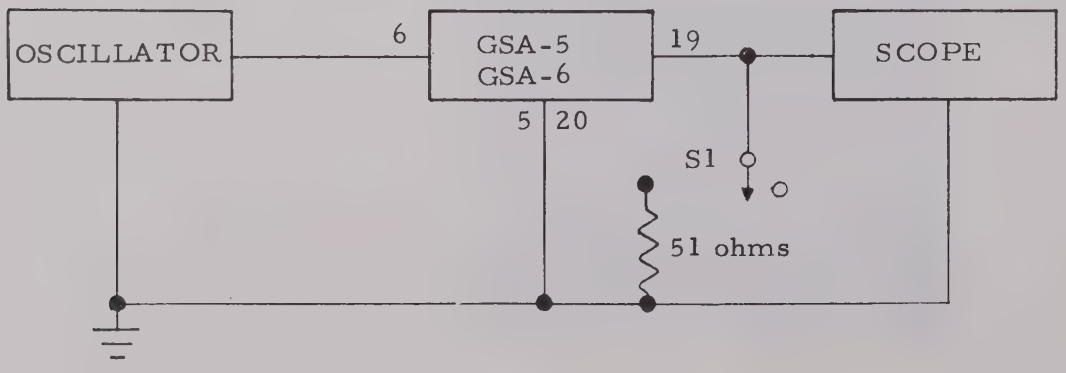
e. Input level on RMS meter should be greater than 110 mv RMS which corresponds to approximately 300 mv peak-to-peak.

5-11. INPUT IMPEDANCE. Set up the equipment as shown below and proceed as follows:



a. Set the OUTPUT LEVEL adjust fully clockwise.
b. Set the resistance decade box for 500 ohms.
c. Set the oscillator to 1 kHz with a level of 0.1 volts RMS.
d. With S1 in the #1 position, record the voltage indicated on the RMS meter.
e. With S1 in the #2 position, select a resistance value which will be equal to 1/2 of the voltage recorded in step c.
f. The input impedance can now be read directly from the decade box with a nominal value of 500 ohms.

5-12. OUTPUT LEVEL. Connect the equipment as shown below and proceed as follows:



a. Set the oscillator to any frequency between 200 Hz and 10 MHz.

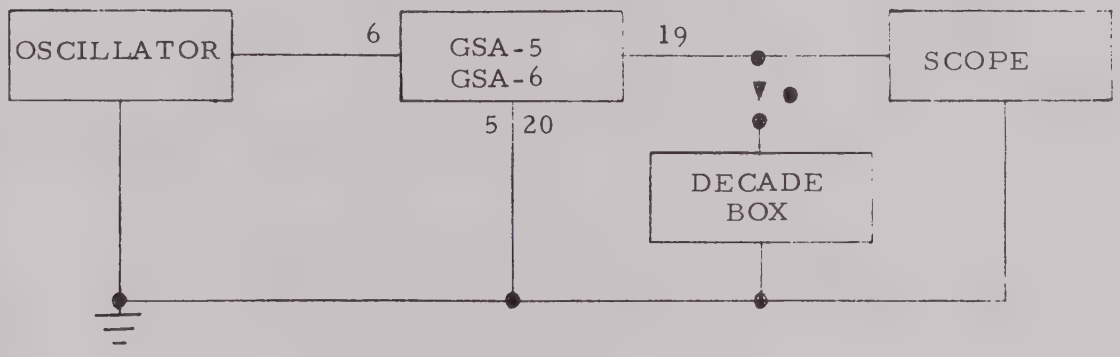
b. Set the OUTPUT LEVEL adjust on the GSA-5/ GSA-6 fully clockwise.

c. Increase the input amplitude until the waveform becomes distorted.

d. With S1 in the open position, the waveform shall be greater than 6 V peak-to-peak.

e. With S1 in the closed position, the waveform shall be greater than 3 V peak-to-peak.

5-13. OUTPUT IMPEDANCE. Connect the equipment as shown below and proceed as follows:



a. Set the oscillator to 1 kHz and level to 0.1 V RMS.

b. With S1 in the open position, record the voltage indicated on the RMS meter.

c. With S1 in the closed position, select a resistance that will give 1/2 the reading in step b.

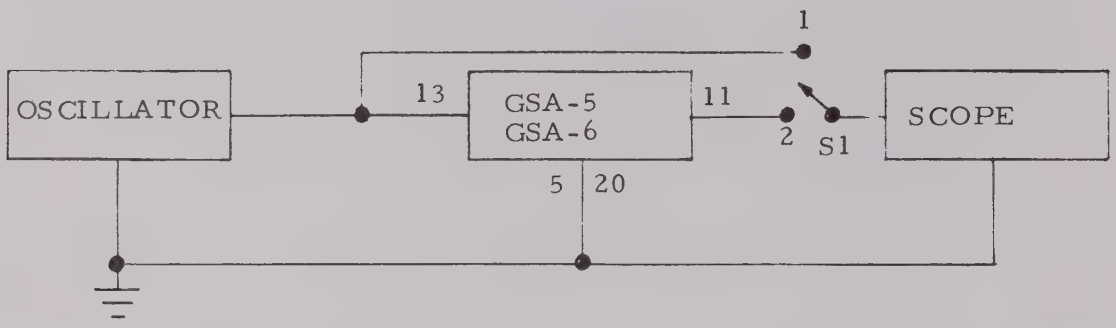
d. The output impedance can now be read directly from the decade box with a nominal value of 50 ohms.

5-14. FREQUENCY RESPONSE. Connect the equipment as shown in paragraph 5-10 and proceed as follows:

a. While maintaining a constant input level of 0.1 V RMS, vary the oscillator from 200 Hz to 10 MHz.

b. The amplitude variation will remain within ±3 db range.

5-15. BUFFER AMPLIFIER OUTPUT LEVEL. Connect the equipment as shown below and proceed as follows:



a. Set the oscillator to any frequency between 200 Hz and 10 MHz.

b. With S1 in the #1 position, adjust the oscillator for a level of 600 MVPP.

c. With S1 in the #2 position, the waveform shall be equal to approximately 600 MVPP.

5-16. TROUBLESHOOTING.

5-17. Troubleshooting the GSA-5/GSA-6 module consists of injecting a signal into the input of the GSA-5 and tracing this signal through its stages.

5-18. Remove the defective GSA-5/GSA-6 from the GMA Housing and remove the cover from the GSA-5/GSA-6. Insert the GTF-2 test fixture into the GMA Housing and plug the GSA-5/GSA-6 into the GTF-2.

5-19. Apply a 1 kHz, 0.1 V RMS signal to Elco pin 6 of the GSA-5/GSA-6. With the scope monitor terminal E111 (see drawings TW-017655 and RA-017772) and check for signal at this point.

5-20. If no signal is present at terminal E111, adjust potentiometer R301 clockwise. If the applied input signal does not appear, check R301 and C128 with an ohmmeter.

5-21. With the input signal present at terminal E111, monitor terminal E110 and check for a 1 kHz, 0.5 V RMS (approximate) signal. If no signal is present at terminal E110, check Q101 through Q104.

5-22. With the proper signal at terminal E110, monitor terminal E107 for a 1 kHz, 2.5 V RMS (approximate) signal. If no signal is present at terminal E107, check Q105 through Q113.

5-23. The meter circuit consists of two active components, Q114 and CR101. If the meter does not function properly, check these two components with an ohmmeter.

CAUTION

Do not check across the meter movement (terminals E105 and E106) with an ohmmeter as the internal battery may destroy the meter movement.

5-24. Apply a 1 kHz, .5 V RMS (approximate) signal to Pin 13 on the GSA-5/GSA-6 (the input to the buffer amplifier) and check for this signal on Pin 11 (the output of the buffer amplifier). If no signal is present in Pin 11, check Q115 and Q116.

5-25. After the defective GSA-5/GSA-6 has been repaired, perform the minimum performance tests as previously described.

NOTE

Paragraph 5-23 does not apply to GSA-6.

Table 5-2. Recommended Spare Parts List, GSA-5/GSA-6

Item No.	Part Number	Description	Qty. per 20 Units
1	BD008923	Meter, DCS, M301 *	1
2	GA2G024S-102	1K Potentiometer, Allen Bradley, R301	1
3	CTP700A	Diode, Clevite, CR101 *	4
4	2N4250	Transistor, Fairchild, Q113, Q112, Q108, Q107, Q103, Q104, Q116	8
5	2N3856	Transistor, G. E., Q114 *, Q111, Q110, Q109, Q101, Q105	6
6	2N3638	Transistor, Fairchild, Q106, Q102	4
7	2N5163	Transistor, (FET), Fairchild, Q115	4

NOTE

The GSA-6 does not include M301, CR101, and Q114. (Meter Circuitry)

SECTION VI

DRAWINGS

6-1. GENERAL.

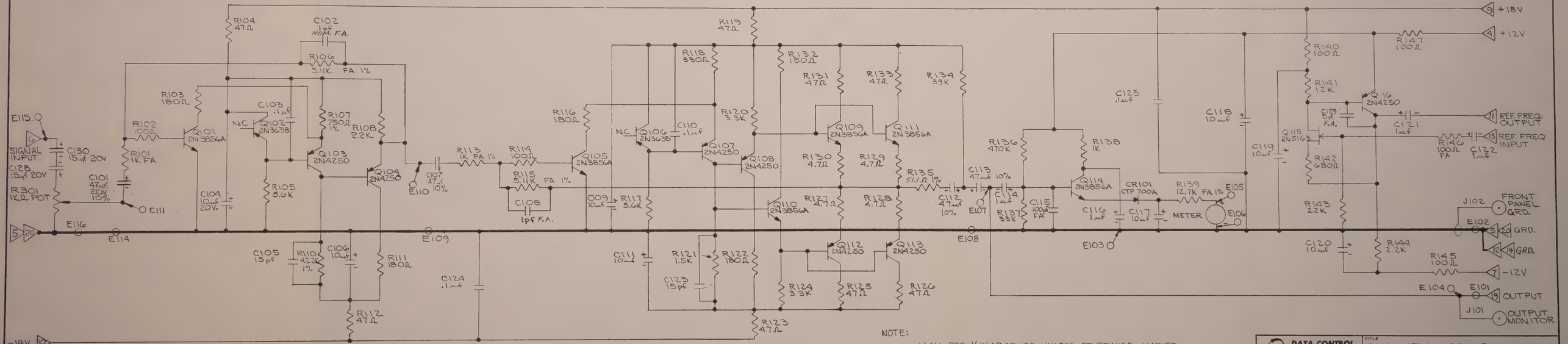
6-2. The drawings listed in this section are furnished to supplement the information given in the text.

017655	Schematic, GSA-5
017722	Board Assembly, GSA-5
017654	Final Assembly, GSA-5
017656	Outline, GSA-5
018627	Schematic, GSA-6
018626	Board Assembly, GSA-6
018630	Final Assembly, GSA-6

REV.	DESCRIPTION	DATE	DWN.	CHK	APP
B	ADDED CAP C-127 PER CA-4433	4/23/68	SR	MR	DR
C	CHG R135 TO 51.1Ω PER CA-4434	4/24/68	DR	MR	DR
D	CA-4452 REVISED	7-2-68	JP	DR	DR
E	CA-4614 CHG'D RES VALUES	7-16-68	JP	DR	DR
F	CA-4625 ADD C130	7-16-68	JP	DR	DR
G	CA-4949, CHG'D CAP. C102	2/13/69	GD	DR	DR
H	CA-5057, CHG'D CAP- C108	5-7-69	GD		

REV	T

ITEM	SYMBOL	DWG NO.	DESCRIPTION	QTY/ASSY



NOTE:

1.) ALL RES, ¼W, AB, CB, 10% UNLESS OTHERWISE MARKED.
2.) ALL UNMARKED CAPACITORS ARE 20%.

REF.	DESCRIPTION	QTY

FIRST PRODUCT	NEXT ASSEMBLY	QTY./ASSY

DATA CONTROL SYSTEMS, INC.

TITLE: SCHEMATIC, GSA-5

TOLERANCES: UNLESS OTHERWISE SPECIFIED	DWN	CHKD	ENG	APP	SCALE
DECIMAL - 3 PLACE ± .005	J.E HOLTZE 4-1-68				
DECIMAL - 2 PLACE ± .010					
FRAC. ± 1/64 ANG. ± 0°30'					
FLATNESS WITHIN /IN.					
FRACTIONAL HOLES ∅ ± 1/64					
NOTE- BREAK ALL SHARP CORNERS .005"-.015"					
SURFACE ROUGHNESS NOT TO EXCEED					

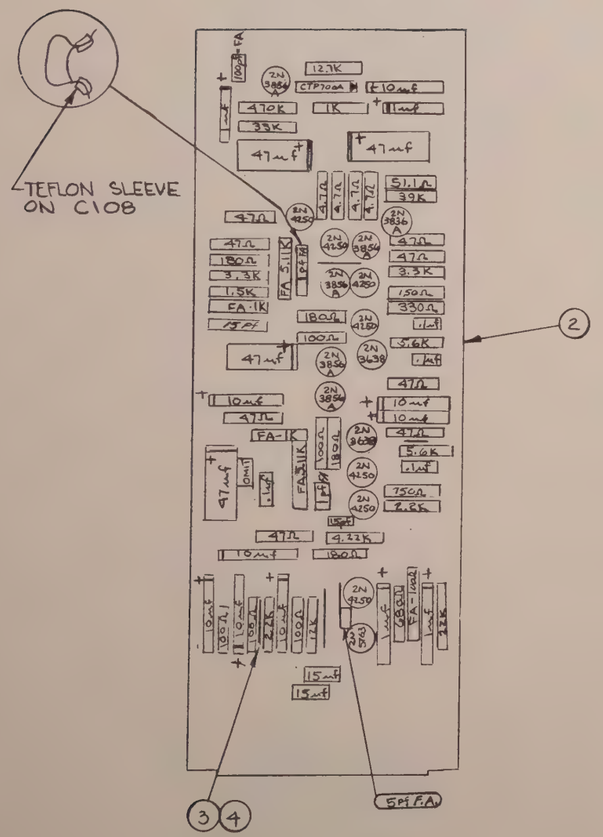
DO NOT SCALE DRAWING

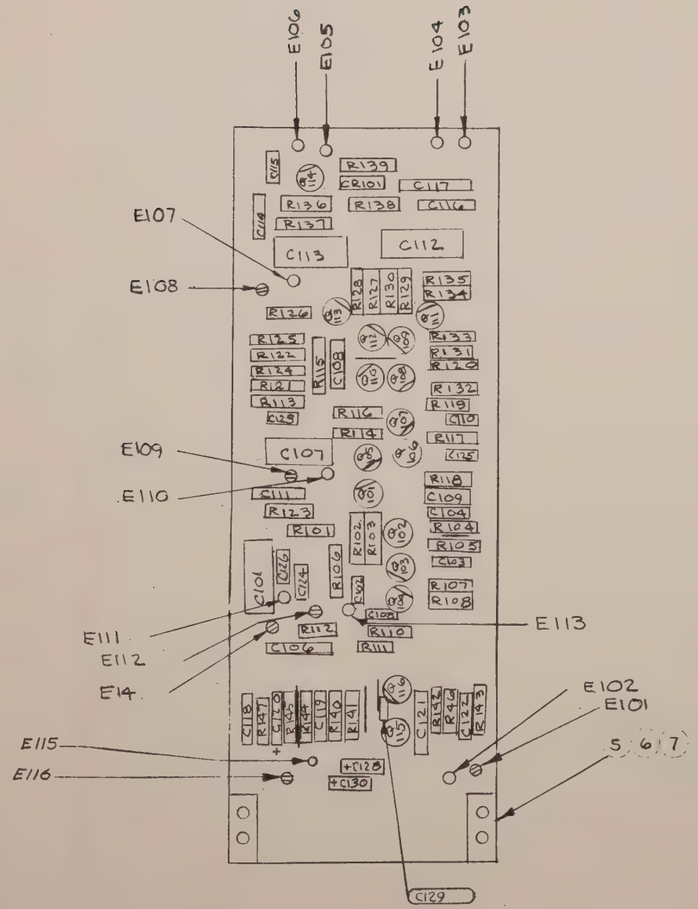
MAT'L

FINISH

TW 017655 REV. H

SHEET





ITEM	SYMBOL	PART NO.	DESCRIPTION	QTY REQ'D
	C123		CAP. DURMICA DM-10 1%, 15pf	1
	C104		CAP, SPRAGUE 150-D 20V, 10mf	1
	C126		OMIT	1
	Q115		TRANS F.E.T., 2N5103	1
	Q113		NSC 2N4250	1
	Q112		2N4250	1
	Q108		2N4250	1
	Q107		2N4250	1
	Q103		2N4250	1
	Q104		2N4250	1
	Q116		2N4250	1
	Q114		GE 2N3856A	1
	Q111		2N3856A	1
	Q117		2N3856A	1
	Q109		2N3856A	1
	Q101		2N3856A	1
	Q105		2N3856A	1
	Q106		FAIRCHILD 2N3638	1
	Q102		2N3638	
	C130		CAP SPRAGUE 150D, 20V, 15μf	1
	CR101		DIODE CTP720A	1
	C128		CAP. SPRAGUE 150D 15μf 20V	1
	C129		DURMICA DM-10 1% 5pf F.A.	1
3			JUMPERS, #22 BUSS WIRE	A/R
4			TEFLON SLEEVING	A/R
5	*	BD-008927	GUIDE BLOCKS	2
6	**	AS-876028-*-10	#4-40 PHMS ST. CD. PL	4
7	*	BD-009835	PLATE, WASHER	2

ITEM	SYMBOL	PART NO.	DE
	R133		RES, AB,CB, 1/
	R141		AB,CB 1/
	R110		ELECTRA
	R107		
	R135		
	R106		
	R101		
	R112		
	R113		AB,CB 1/
	R115		ELECTRA
	R139		
	R132		AB,CB, 1/
	C106		CAP, SPRAG
	C109		
	C117		
	C118		
	C119		
	C120		
	C115		DUPLICA
	C114		SPRAGUE
	C116		
	C121		
	C122		
	C101		
	C107		
	C112		
	C113		
	C103		RMC, TA, 1
	C110		
	C111		SPRAGUE
	C124		RMC, TA, 1
	C125		
	C102		DURMICA, D
	C108		
	C105		

V, 10%,	47Ω	1		
V, 10%,	12K	1		
F5C-D 1%		1		
	750Ω	1		
	51.1Ω	1		
	FA 5.11K	1		
	FA, 1K Ω	1		
	FA 1K	1		
1, 10%,	3?Ω	1		
5C-D 1%, 1/4W FA	5.11K	1		
	FA 12.7K	1		
1, 10%,	150Ω	1		
., 150-D, 20V,	10uf	1		
	10uf	1		
	10uf	1		
	10uf	1		
	10uf	1		
DM-10 FA,	100pf	1		
150D	1uf	1		
	1uf	1		
	1uf	1		
	1uf	1		
10%	47uf	1		
10%	47uf	1		
10%	47uf	1		
10%	47uf	1		
0V.	.1uf	1		
	.1uf	1		
150D	10uf	1		
0V	.1uf	1		
	.1uf	1		
1-10, NOM F.A.	1pf	1		
NOM F.A.	1pf	1		
	5pf	1		
CRIPTION		QTY. REQ'D		

ITEM	SYMBOL	PART NO.	DESCRIPTION	QTY REQ'D
1	*	TW-017655	SCHEMATIC	REF
2	*	DF-017636	BOARD FAB	REF
	R117		RES., AB, CB, 1/4W, 10%, 5.6K	1
	R102		RES, AB, CB 1/4W, 10%, 33...	1
	R114		100Ω	1
	R140		100Ω	1
	R145		100Ω	1
	R147		100Ω	1
	R122		180Ω	1
	R146		F.A., 33Ω	1
	R103		180Ω	1
	R111		180Ω	1
	R116		180Ω	1
	R121		1.5K	1
	R142		680Ω	1
	R103		2.2K	1
	R138		1K	1
	R144		2.2K	1
	R120		3.3K	1
	R124		3.3K	1
	R105		5.6K	1
	R143		22K	1
	R137		33K	1
	R134		39K	1
	R136		470K	1
	R127		4.7Ω	1
	R133		4.7Ω	1
	R129		4.7Ω	1
	R130		4.7Ω	1
	R104		47Ω	1
	R112		47Ω	1
	R119		47Ω	1
	R123		47Ω	1
	R125		47Ω	1
	R126		47Ω	1
	R131		47Ω	1

REVISIONS

SYM.	DESCRIPTION	DATE	BY	CHK'D	APP'D
B	ADDED CAP C127 PER CA-4422	4/23/68	GR	GR	GR
C	CHG R135 TO 51.1Ω PER CA 4434	4/24/68	GR	GR	GR
D	CA-4452 ADD C128 & C129	7-2-68	GR	GR	GR
E	CA.4406 ADD POLARITY TO CAP.	7-2-68	GR	GR	GR
F	CA.4614 CHG'D COMP. VALUES	7-16-68	GR	GR	GR
G	CA-4625 ADD C130	7-16-68	GR	GR	GR
H	CA-4625-1 UPDATED ASS'Y & ARTWK.	10/14/68	JEH.	GR	GR
J	CA-4949, CHG'D CAPS.	2-13-69	GCD.	GR	GR
K	CA-5057, CHG'D CAP C108	5-7-69	GCD	GR	GR

NOTES:
1) * = LATEST REVISION
2) ** = SCREW LENGTHS TO BE DETERMINED IN ACCORDANCE WITH DCS WORKMANSHIP MANUAL #AS-832011.

DATA CONTROL SYSTEMS, INC.

TITLE: BD. ASS'Y, MASTER BOARD

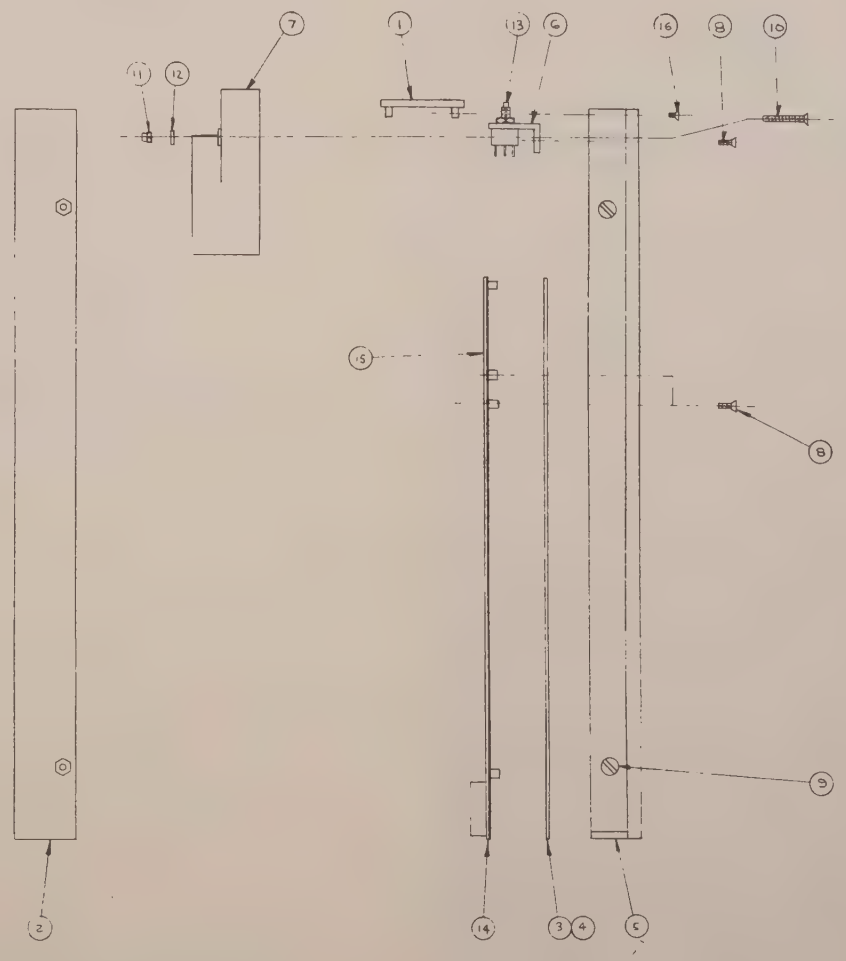
TOLERANCES: UNLESS OTHERWISE SPECIFIED
DECIMAL - 3 PLACE ± .005
DECIMAL - 2 PLACE ± .010
FRAC. ± 1/64 ANG. ± 0°30'
FLATNESS WITHIN /IN.
FRACTIONAL HOLES -0, + 1/64
NOTE: BREAK ALL SHARP CORNERS .005"-.015"

DWN. J.E. HOLZE DATE 3/27/68
CHKD. [illegible] 4-5-68
PROJ. ENG. [illegible] 4/16/68
CH. ENG. [illegible] 4/16/68
SCALE ~

DO NOT SCALE DRAWING
MAT'L
FINISH
RA 017722 K

GSA-5 CA-017654 1

REV	ZONE	DESCRIPTION	DATE	DWN	CHK	APP
B	~	CA-4452, CHG'D POT VALUE	1/17/68	GCD	MR	MR



ITEM	SYMBOL	DWG NO	DESCRIPTION	QTY PER ASSY
1	*	CA-017654	ASSY, FRONT PANEL	1
2	*	BF-012905	COVER FAB	1
3	*	BD-013048	INSULATOR	1
4			ADHESIVE, ARMSTRONG #A-111	A/R
5	*	CD-012804	CHASSIS	1
6	*	BD-009967	BRACKET, POT	1
7	M301	BD-008923*	METER	1
8	**	AS-826026-*25	SCR, #2-56, NC-2A x 3/16 LG, 100° FHMS	10
9	**	AS-826026-*40	SCR, #4-40, NC-2A x 1/8 LG, 100° FHMS	4
10	**	AS-826026-*26	SCR, #2-56, NC-2A x 1/16 LG, 100° FHMS	2
11	**	AS-826020-*26	NUT, ESNA LOCKNUT #92-1660-26	2
12	**	AS-826017-*08	WASHER, #2 FLAT	2
13	R301		RES, POT, GAZG0249-102.1K Ω	1
14	*	RA-017722	BOARD ASSY, MASTER	1
15				
16	**	AS-826026-*26	SCR, #2-56, NC-2A x 1/8 LG, 100° FHMS	6

NOTES:
1) * LATEST REVISION.
2) ** SCREW LENGTHS TO BE DETERMINED IN ACCORDANCE WITH DCS. WORKMANSHIP MANUAL #AS-832011.

CA-017654 B

REF	DESCRIPTION	QTY

OGILVIE PRESS, INC. MILWAUKEE, WIS. 48201

GSA-5 (PRODUCT) | (NEXT ASSEMBLY) | (QTY — LAST)

DATA CONTROL SYSTEMS, INC.

TITLE: FINAL ASSY, GSA-5

TOLERANCES: UNLESS OTHERWISE SPECIFIED
DECIMAL - 3 PLACE ± .005
DECIMAL - 2 PLACE ± .010
FRAC ± 1/64 ANG ± 0°30'
PLATHERS WITHIN ~ /64 IN.
FRACTIONAL HOLES -0 ± 1/64
NOTE: BREAK ALL SHARP CORNERS .005", .010" SURFACE ROUGHNESS NOT TO EXCEED ~

DWN.	G.C.D.	1/17/68
CHK'D.	MR	1/17/68
ENG.		1/17/68
APP.		1/17/68

SCALE: FULL

DO NOT SCALE DRAWING

MATL

FINISH

CA-017654 REV. B

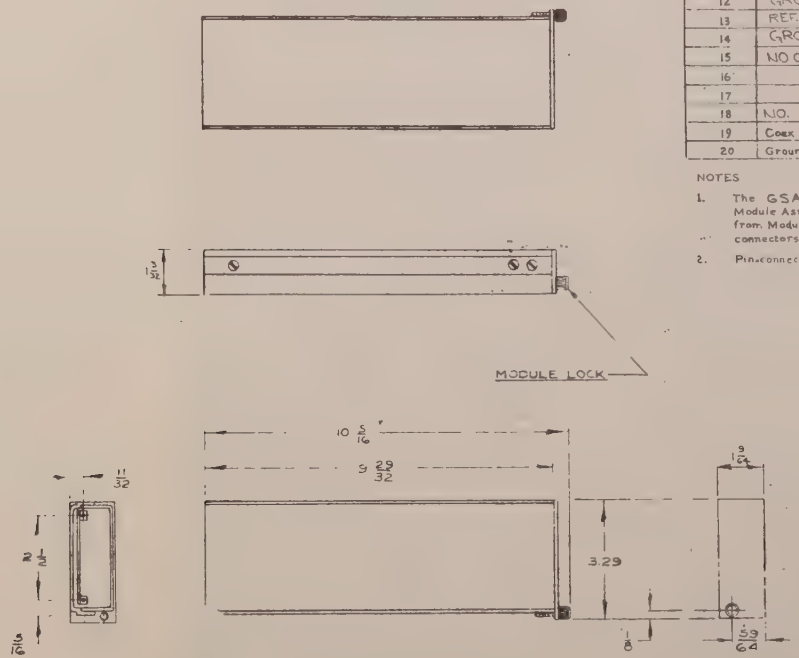
SHEET

REV	ZONE	DESCRIPTION	DATE	DWN	CHK	APP
B		CA 1529 CHG TO PIN CALLOUTS ETC				

PIN	TABULATION OF DESIGNATIONS
1	NO CONNECTION
2	
3	
4	+12 Volts D.C.
5	Ground
6	SIGNAL INPUT
7	-1 V
8	-35 Volts D.C.
9	+18 Volts Unregulated
10	-18 Volts Unregulated
11	REF. FREQ OUTPUT
12	GROUND
13	REF. FREQ INPUT
14	GROUND
15	NO CONNECTION
16	
17	
18	NO. CONNECTION
19	Coax Signal Lead Output
20	Ground Output

NOTES

1. The GSA-[ ] plugs into the DCS Model GMA-1 or GMA-3 Module Assembly. All power and signal connections are made from Module Assembly GSA-[ ] to GMA-1 via Elco connectors as tabulated.
2. Pin connections are numbered from top to bottom

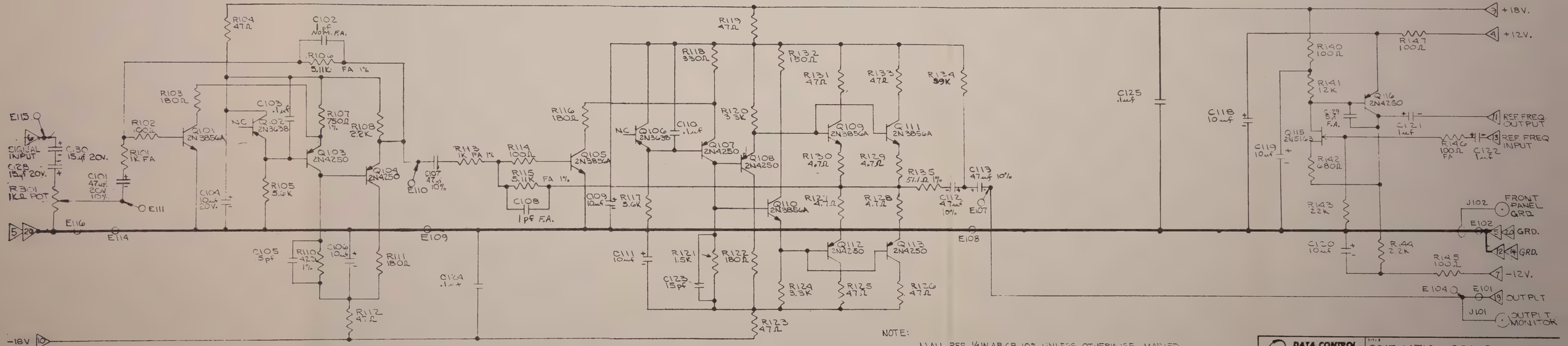


DATA CONTROL SYSTEMS, INC.	TITLE: OUTLINE
TOLERANCES UNLESS OTHERWISE SPEC'D: DECIMAL 2 PLACE ± .010; DECIMAL 3 PLACE ± .010; FRAC ± 1/32 AND ± 0 30'; FLATNESS WITHIN .001 IN.; FRACTIONAL HOLES 0 ± 1/16; NOTE BREAK ALL SHARP CORNERS .005 .015; SURFACE ROUGHNESS NOT TO EXCEED	J.E. HOLZE 3/7/68 DWN; CHKD; ENG; APP PBC 4/6/68; SCALE FULL
DO NOT SCALE DRAWING	MAT'L; FINISH
CO-017656	REV. B
PRODUCT: GSA-5	NEXT ASSEMBLY
SHEET	

REV	DESCRIPTION	QTY

REV	DESCRIPTION	DATE	DWN	CHK	APP
B	CA-5057, CHGD C108	5-7-69	GCD		

ITEM	SYMBOL	DWG NO.	DESCRIPTION	QTY/ASSY



NOTE:

1.) ALL RES. ¼W AB CB 10% UNLESS OTHERWISE MARKED.
2.) ALL UNMARKED CAPACITORS ARE 20%.

REF	DESCRIPTION	QTY

GSA-6	~	REF
FIRST PRODUCT	NEXT ASSEMBLY	QTY/ASSY

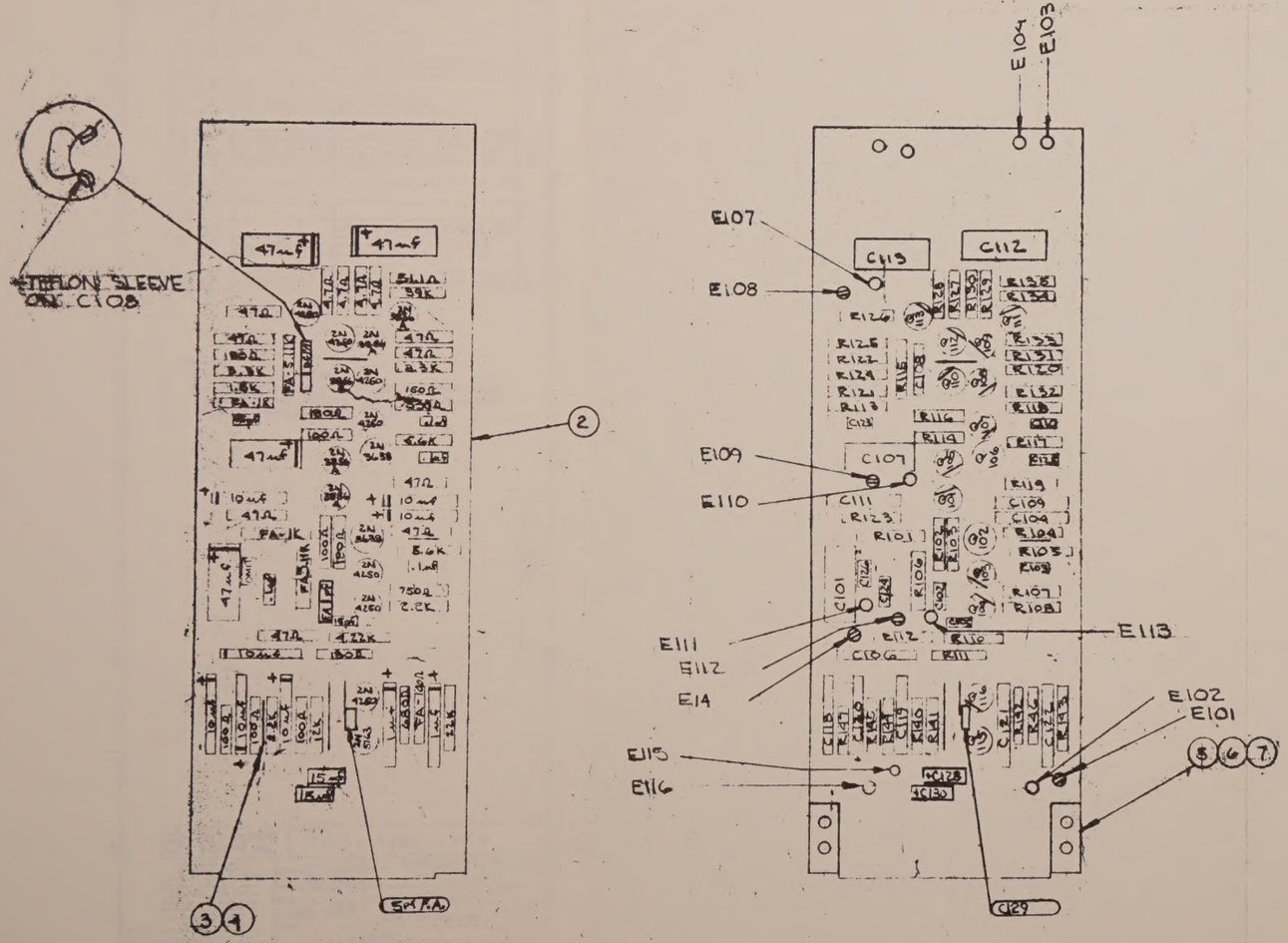
DATA CONTROL SYSTEMS, INC.

TITLE: SCHEMATIC, GSA-6

TOLERANCES UNLESS OTHERWISE SPECIFIED
DECIMAL - 3 PLACE ± .005
DECIMAL - 2 PLACE ± .010
FRAC. ± 1/64 ANG ± 0°30'
FLATNESS WITHIN .1/IN.
FRACTIONAL HOLES -0 + 1/64
NOTE- BREAK ALL SHARP CORNERS .005"-.018"
SURFACE ROUGHNESS NOT TO EXCEED ~

		DATE
DWN	G.C.D.	1/7/69
CHKD	[illegible]	1/24/69
ENG		
APP	[illegible]	3/6/69
SCALE	~	

DO NOT SCALE DRAWING
MAT'L ~
FINISH ~
TW-018627
REV B
SIZE



ITEM	SYMBOL	PART NO.	DESCRIPTION	QTY REQ'D
	C123		CAP, DURMICA DM-10, 1%. 15pf	1
	C104		CAP, SPRAGUE 150-D 20V, 10mf	1
	C126		↓ OMIT	1
	Q115		TRANS F.E.T. 2N5163	1
	Q113		NSC 2N4250	1
	Q112		2N4250	1
	Q108		2N4250	1
	Q107		2N4250	1
	Q103		2N4250	1
	Q104		2N4250	1
	Q116		2N4250	1
	Q111		G.E. 2N3856A	1
	Q110		2N3856A	1
	Q109		2N3856A	1
	Q101		2N3856A	1
	Q105		2N3856A	1
	Q106		FAIRCHILD 2N3638	1
	Q102		2N3638	1
	C130		CAP SPRAGUE 150D, 20V, 15mf	-1
	C128		CAP. SPRAGUE 150D 15mf 20V	1
	C129		↓ DURMICA DM-0 1% 5pf FA.	1
3			JUMPERS, #22 BUSS WIRE	A/R
4			TEFLON SLEEVING	A/R
5	*	BD-008927	GUIDE BLOCKS	2
6	**	AS-820028-*-40	#4-40 PHMS ST. CD. PL	4
7	*	BD-009835	PLATE, WASHER	2

ITEM	SYMBOL	PART NO.	DESCRIPTION
	R133		RES. AB,CB 1/4
	R141		AB,CB 1/4
	R110		ELECTRA
	R107		
	R135		
	R106		
	R101		
	R113		↓
	R118		AB,CB 1/4
	R115		ELECTRA
			↓
	R132		AB,CB 1/4
	C106		CAP, SPRAG
	C109		
	C117		
	C118		
	C119		
	C120		
	C121		CAP, SPRAGUE
	C122		
	C101		
	C107		
	C112		
	C113		↓
	C103		RMC, TA
	C110		↓
	C111		SPRAGUE
	C124		RMC, TA
	C125		↓
	C102		DURMICA
	C108		
	C105		↓

W, 10%	47Ω	1		
W. 10%	12K	1		
MF5C-D 1% 1/4W	422K	1		
	750Ω	1		
	51.1Ω	1		
	FA 5.11K	1		
	FA. 1KΩ	1		
	FA 1K	1		
W. 10%.	330Ω	1		
F5C-D 1% 1/4W FA	5.11K	1		
V 10%	150Ω	1		
E. 150 D. 20V,	10uf	1		
	10uf	1		
	10uf	1		
	10uf	1		
	10uf	1		
	10uf	1		
150-D 20V.	1uf	1		
	1uf	1		
	10% 47uf	1		
	10% 47uf	1		
	10% 47uf	1		
	10% 47uf	1		
0V.	.1uf	1		
	.1uf	1		
150D	10uf	1		
0V	.1uf	1		
	.1uf	1		
M-10, 1% NOM. FA.	1 pf	1		
	NOM F.A. 1pf.	1		
	15 pf	1		
CRIPTION		QTY. REQ'D		

ITEM	SYMBOL	PART NO.	DESCRIPTION	QTY. REQ'D
1	*	TW-018627	SCHEMATIC	REF
2	*	DF-017636	BOARD FAB	REF
	R117		RES, AB CB 1/4W 10% 5.6K	1
	R102		RES, AB CB 1/4W 10% [illegible]	1
	R114		100Ω	1
	R40		100Ω	1
	R45		100Ω	1
	R47		[illegible]	1
	R122		180[illegible]	1
	R146		FA. [illegible]Ω	1
	R103		180Ω	1
	R111		180[illegible]	1
	R116		180[illegible]	1
	R121		1.5K	1
	R142		680[illegible]	1
	R103		2.2K	1
	R144		2.[illegible]K	1
	R120		3.3K	1
	R124		3.3K	1
	R105		5.6K	1
	R143		22K	1
	R134		39K	1
	R127		47[illegible]	1
	R123		47Ω	1
	R129		47Ω	1
	R130		47Ω	1
	R104		47Ω	1
	R112		47Ω	1
	R119		47Ω	1
	R133		47Ω	1
	R125		47Ω	1
	R126		47Ω	1
	R131		47Ω	1

REVISIONS

SYM.	DESCRIPTION	DATE	BY	CHK'D	APP'D
B	CA-5057, CHGD CAR C108	5-7-69	GCD		

NOTES:
1) * = LATEST REVISION
2) ** = SCREW LENGTHS TO BE DETERMINED IN ACCORDANCE WITH DCS WORKMANSHIP MANUAL #AS-832011.

DATA CONTROL SYSTEMS, INC.

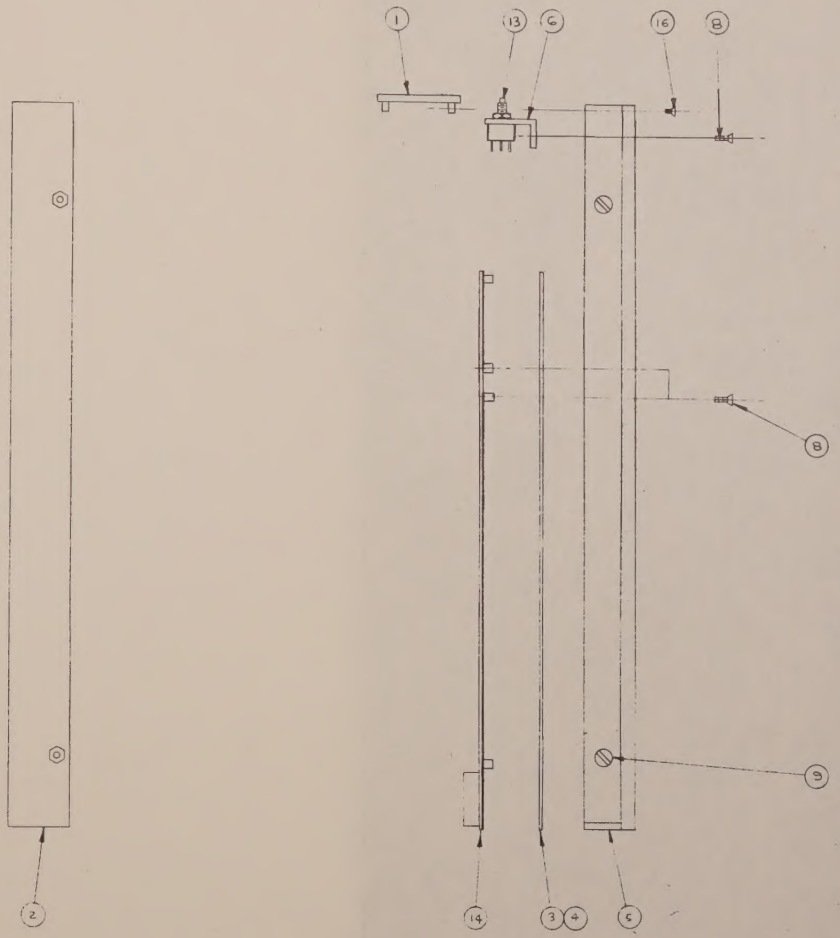
TITLE: BD. ASS'Y, MASTER BOARD

TOLERANCES UNLESS OTHERWISE SPECIFIED
DECIMAL - 3 PLACE ± .005
DECIMAL - 2 PLACE ± .010
FRAC ± 1/64 ANG. ± 0°30'
FLATNESS WITHIN /IN.
FRACTIONAL HOLES -0, + 1/64
NOTE: BREAK ALL SHARP CORNERS .005"-.015"

DWN. GCD	1/20/69	DO NOT SCALE DRAWING
CHK'D GR	1/23/69	MAT'L
PROJ. ENG		FINISH
CH. ENG. RY	2-6/69	
SCALE		RA-018626 B

GSA-6 CA-018630 1

REV	ZONE	DESCRIPTION	DATE	DWN	CHK	APP



ITEM	SYMBOL	DWG. NO.	DESCRIPTION	QTY / SHEET
1	*	BA-018628	ASSY, FRONT PANEL	1
2	*	BF-012905	COVER FAB	1
3	*	BD-013048	INSULATOR	1
4			ADHESIVE, ARMSTRONG #N-111	A/R
5	*	CD-012804	CHASSIS	1
6	*	BD-009967	BRACKET, POT	1
8	**	AS-826026-#26	SCR, #2-56, NC-2A x 3/16 LG, 100° FHMS	10
9	**	AS-826026-#40	SCR, #4-40, NC-2A x 1/8 LG, 100° FHMS	4
10				
11				
12				
13	R301		RES, POT, GAZG0249-102 1KΩ	1
14	*	RA-018626	BOARD ASSY, MASTER	1
16	**	AS-826026-#26	SCR, #2-56, NC-2A x 1/8 LG, 100° FHMS	6

NOTES:
1.) * LATEST REVISIONS.
2.) ** SCREW LENGTHS TO BE DETERMINED IN ACCORDANCE WITH D.C.S. WORKMANSHIP MANUAL #AS-832011.

CA-018630 REV A

REF	DESCRIPTION	QTY

ORILYNE PRESS, INC. ULTRAVEL NO. 4000M

GSA-6 — PRODUCT — NEXT ASSEMBLY — QTY / SHEET

DATA CONTROL SYSTEMS, INC.

TITLE: FINAL ASSY, GSA-6

TOLERANCES: UNLESS OTHERWISE SPECIFIED
DECIMAL - 3 PLACE ± .005
DECIMAL - 2 PLACE ± .010
FRAC. ± 1/64 AND ± 0° 30'
FLATNESS WITHIN .../IN
FRACTIONAL HOLES ø ± 1/64
NOTE: BREAK ALL SHARP CORNERS .005" - .015"
SURFACE ROUGHNESS NOT TO EXCEED ...

		DATE
DWN. SAD		1/7/69
CHKD. MR		1/24/69
ENG.		
APP. DH		2/6/69
SCALE		

DO NOT SCALE DRAWING
MATL
FINISH
CA-018630 REV A
SHEET